

SCIENCE

FRIDAY, SEPTEMBER 30, 1887.

IN A RECENT NUMBER of *Science* (x. No. 240) we had occasion to refer to the beneficent law now existing in several of the States, prohibiting the employment of color-blind persons on the railroads of those States, and instanced Massachusetts as the first one to enact such a law. At a meeting of the Brotherhood of Locomotive Engineers, just held in Boston, at which three thousand railroad-engineers were said to be present, one of the speakers who addressed the audience was received with great applause, because, as the chairman said in introducing him, "he secured the repeal of the obnoxious color-blind law,"—a questionable honor, if true; but, from the best information which we are able to obtain, the law still exists, although it has been modified in a manner which in no wise weakens, but, on the contrary, rather strengthens, its practical working. It is not to be wondered at that railroad employees object to a test of their qualifications which may result in the loss of their positions, but we imagine that any attempt to repeal the law would meet with the determined opposition of the entire travelling public. The single instance which occurred in Connecticut, where twenty-one railroad employees were found wholly color-blind, is sufficient proof of the necessity of such a law, and, instead of endeavoring to repeal existing laws, a strong and continuous effort should be made to extend their provisions to other States.

DISTILLERY-MILK REPORT.—V.

THE attempt which *Science* has made to obtain facts and opinions in reference to the effect of distillery-swill upon the animals to which it was fed, both as to their health and the wholesomeness of the milk secreted by them, has been measurably successful. As was to have been anticipated, the opinions greatly outnumber the facts. To any one who has had experience in similar inquiries this will be a matter of no surprise. The difficulties surrounding a mathematical demonstration of a problem so intricate as this are well-nigh insurmountable, unless a thorough investigation is made by skilful and competent men with all the necessary means at their disposal. The fact that such an inquiry into the matter under consideration has never been made, is very evident from a perusal of the replies which *Science* has received from its correspondents. These replies show that medical and other professional men are divided as to the effect of swill-milk upon human beings, although those who regard it as unwholesome food, and as injurious to those who consume it, greatly preponderate. The evidence seems also to point to the conclusion that when distillery-swill is fed to cows in connection with other food, and the cows kept in properly ventilated and clean stables, with a sufficient amount of exercise in the open air, it is not injurious to these animals. But, on the other hand, it likewise appears, that as ordinarily fed to animals that are confined continuously in close and filthy stables, without admixture with other food, the consequences, both to the animals themselves and to their secretion, are most pernicious.

The lack of definite knowledge on a subject of such vital interest is greatly deplored by those who have expressed themselves on this point, and it would seem that the time has come for a thorough investigation into the question at issue. Until within a few years, such an inquiry could only have been made by individuals or by societies, in much the same manner as was undertaken by the New York Academy of Medicine in 1858. It is manifest that the results to be obtained in this way, valuable as they are for some purposes, cannot definitely settle the question so as to satisfy the minds of all. If the experimental stations established by both the national and State governments cannot take up an issue of such general im-

portance as this, it is very much to be regretted. Believing, however, that such is their legitimate work, we shall endeavor, by every means in our power, to bring about this desirable action on the part of the stations, and would solicit the assistance, in the accomplishment of this end, of all who have the necessary influence. We shall also take the liberty of suggesting the general plan upon which such an investigation should be carried out. This we do with the greater assurance, because we have received most valuable suggestions from Professors Law and Brewer, and Drs. Sturtevant, Newton, Salmon, and other authorities, with whom we are in perfect accord.

One suggestion made by Professor Brewer, would, if carried into practice, be a crucial experiment. He says, "If you can convince a few orphan-asylums and foundling-hospitals that it would be an innocent and harmless experiment to feed half of their children on distillery-swill milk, and the other on grass-and-grain milk, and continue this experiment for several years, on different races of children, in different localities, some of the swill-milk stables to be kept as clean as other stables may be, by some process not yet announced, and carefully record and collate all the results, the question would then be settled, in the usual acceptance of that term." The impracticability of such a plan no one appreciates better than Professor Brewer. He therefore adds, "Until some such plan for 'positive evidence' be secured, I suggest that you work at the method of cumulative evidence, which has been so rich in conclusions and beneficent in its results in other departments of sanitary science."

There appears to be some difference of opinion as to the exact chemical composition of distillery-swill, under different circumstances; so that in carrying out any experiments the following points, as suggested by Professor Law, should be ascertained and recorded: (1) Is the swill fresh? (2) Has it undergone any other than the alcoholic fermentation? (3) Is it uniform in quality as supplied from day to day? (4) At what heat is it fed? (5) Does it contain the simple original grain-products,—gluten, salts, etc.,—or has there been added any chemical agent used in the manufacture of the alcoholic liquid? These inquiries are necessary, because the effect of swill when fresh may be entirely different from swill in an acid or decomposed state, and the allegation has also been made that injurious chemical agents are added. The temperature of the stables in which the experimental animals are housed should also be recorded. In short, every condition which is liable to enter as a factor into the problem should be intelligently regarded. Dr. Salmon advises that biological analyses of the milk should be made, in order to determine the relative number of germs as compared with milk from country pastures.

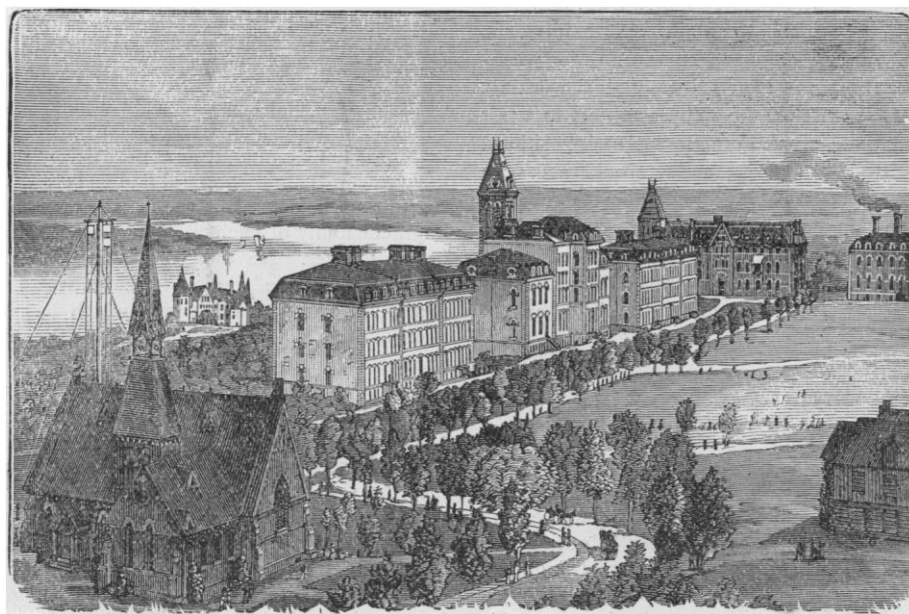
Hitherto chemical analysis has been mainly relied on in determining the quality of the milk; but, as Dr. Sturtevant remarks, "while this is of assistance, it cannot alone determine the questions relative to healthfulness. The question should be investigated from the chemico-physiological standpoint: determine whether substances not met with in ordinary foods can be traced through the animal to the milk; whether bacterial germs exist in the food, and whether such can be traced through the animal to the milk; whether animals of a delicate nature will succumb, or show indication of disease, when fed with suspected milk, while other individuals thrive upon a milk considered of a fine quality. The development of ptomaines in feeding substances through neglect of proper precaution should also receive investigation, as a food otherwise useful may at times become dangerous on the neglect of ordinary precaution."

Dr. Salmon does not regard the studying of milk from healthy cattle, fed upon swill under favorable hygienic conditions, as of much value towards elucidating the practical questions involved. "The question," he says, "is not, whether a small quantity of cool

and fresh swill, fed with a suitably prepared ration of other articles of food to healthy cows, having clean, roomy stables, and plenty of exercise, is injurious to the milk, but it is this: Is wholesome milk produced by feeding swill under the conditions in which it is fed in practice, and must be fed in order to make it a profitable industry?" And finally, as Professor Rohé so well expresses it, "a scientific solution of the question will not be furthered by prejudiced appeals or unreasoning denunciation. Patient investigation, keeping in view all circumstances of the question, and avoiding all one-sidedness in considering the matter, will alone bring about the object desired."

With these suggestions to those having in charge the experiment stations, we leave the subject with our readers. We shall be glad to record any observations or experiences which any one may send us in the future; so that, even if public interest cannot be sufficiently aroused to bring about a proper investigation of the subject at the present time, it may, by a reminder from time to time, be kept alive until the demand for such an inquiry becomes irresistible.

up to the present time, about two hundred students. To prepare for the incoming class of 1887, therefore, it became necessary to still further extend its buildings. It was thought advisable to more than double the size of the wood-working shops, to increase facilities for instruction in the other shops, and to secure fifty per cent more space for drawing-rooms. The freehand-drawing class alone, this year, which includes students from several other courses not included in the mechanical engineering departments, is expected to number over two hundred and fifty students, and occupies two floors of the main building. The wood-working part of the establishment must accommodate between one hundred and one hundred and twenty-five men, and the other shops as many more. To meet this emergency, a new building was planned, into which all the laboratory apparatus used in either instruction or research could be removed; thus giving ample space, for the present at least, for the extension of the shops, by giving to them the considerable space so vacated, while the remainder of the new structure could be devoted to the purposes of the departments of drawing and machine design.



NORTHERN HALF OF CAMPUS FROM SAGE COLLEGE, CORNELL UNIVERSITY.

THE SIBLEY COLLEGE EXTENSION, CORNELL UNIVERSITY.

THE extraordinarily rapid growth of the Sibley College of Cornell University since its re-organization and expansion of two years ago, with the introduction of the course and department of mechanical engineering under Professor Thurston, the extension of its shops and department of the mechanic arts under Professor Morris, and the formation of a carefully planned department of the graphic arts under Professor Cleaves,—all under the general direction of Dr. Thurston,—has compelled a corresponding extension of the accommodations for class and lecture rooms, and especially for shops and drawing-rooms. Two years ago, before this re-organization had taken effect, the number of students taking this course was very small, varying from twenty to thirty, perhaps. Last year the freshman class, including mechanical engineers in regular course, in electrical engineering, and special students with the resident graduates, numbered above eighty. The number of applicants this year is so large that the limit for the entering class is necessarily fixed by the capacity of the shops and buildings, including the mechanical laboratory. It is probable that the numbers received in all classes will exceed two hundred and fifty. When all classes are filled on the basis now taken, the college will number something over three hundred students.

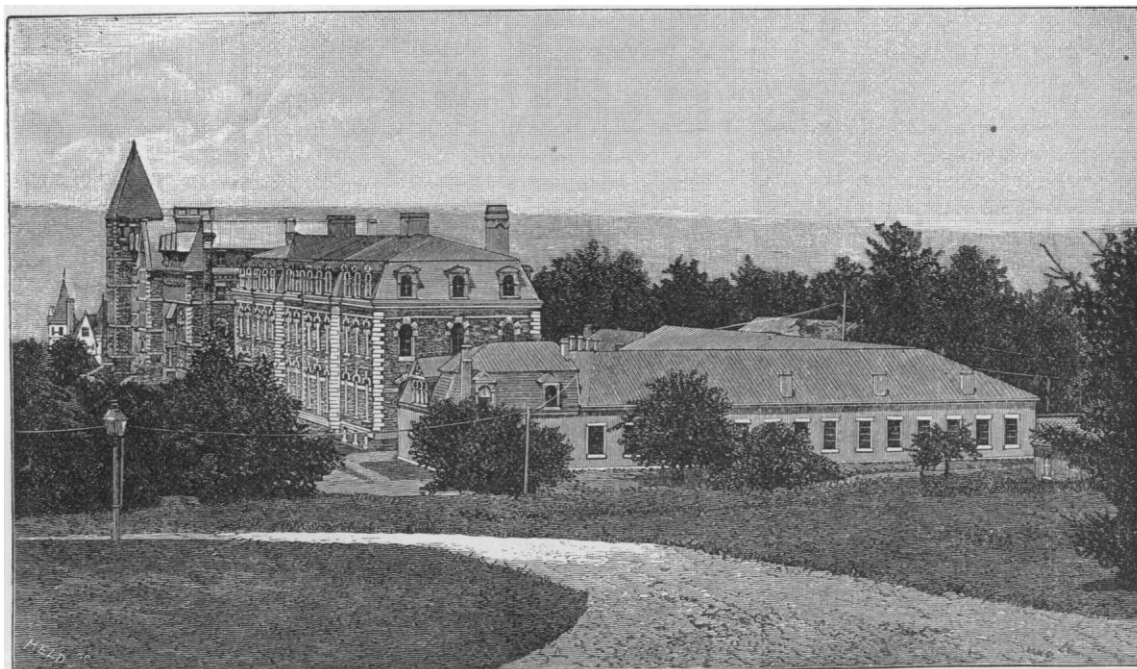
But it was originally designed to accommodate very small classes; and, notwithstanding the fact that within a few years it has been more than doubled in extent, it could only accommodate,

The engraving on the next page shows the extent and arrangements of the departments of the original group of Sibley College buildings. The main building is seen at the front and left; while beyond it is the laboratory building, in which instruction in chemistry and physics, and the principal part of the tuition and practice in electrical engineering, are carried on. The dynamo-room is in the rear of the main building of Sibley College, and contains a considerable number, and hardly less variety, of dynamo-electric machines, used in the course in electrical engineering principally. The lower floor of this building is devoted to the purposes of library and reading-room, museums, a lecture-room for the junior class, and the rooms of the professor of the mechanic arts. The second floor contains two large drawing-rooms, the lecture-room of the professor of mechanical engineering, and the rooms of the director. The third floor is occupied by the rooms of the professor of drawing,—his office, lecture-room, and two large drawing-rooms like those below. All these drawing-rooms are expected to be occupied by the lower classes; while the senior and junior-classes will have their drawing-rooms in the new structure, now just occupied, which building will also accommodate the resident graduates, professors, and others coming to Cornell for advanced work in this department of the university.

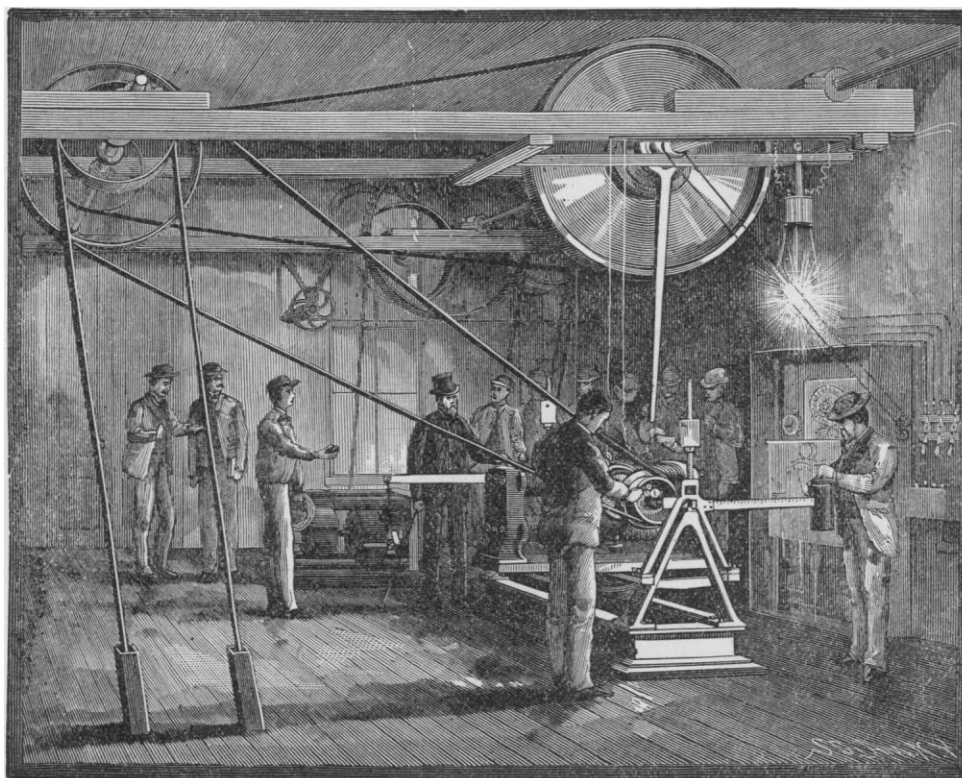
The accompanying plans present the arrangement of the building forming the last of the Sibley College extensions, and now just completed for occupation at the beginning of the college-year 1887-88. It is calculated to be of sufficient size to accommodate the ac-

cessions of the present year. Should the limit of numbers admitted be increased another year, further extension will be again necessary. This number (one hundred in the freshman class and about three hundred total) cannot, however, be increased until the science laboratories are enlarged. The physical laboratory, which was

courses, this limits the number which can be taken as that of the entering classes in the Sibley College as effectively as the size of the college itself. The number of students in the technical courses of Cornell University this year is not far from six hundred, in the university a thousand undergraduates.



SIBLEY COLLEGE (FROM THE EAST).



SIBLEY COLLEGE DYNAMO AND ELECTRICAL ROOM.

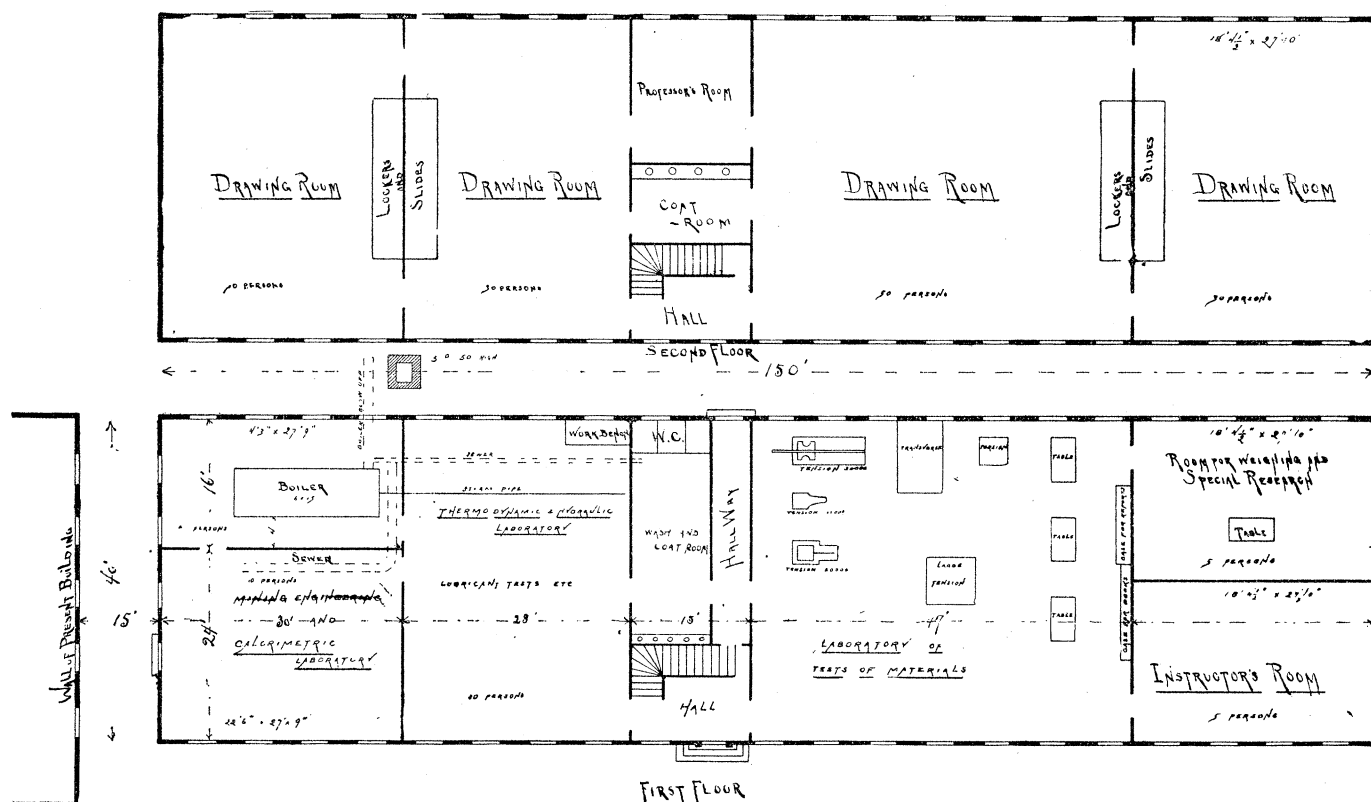
built to give ample accommodation to the classes of three or four years ago, and to work forty or fifty students, was last year called upon to receive eighty, and must this year accommodate one hundred. Further extension must precede any further increase in numbers received there; and as this is an essential part of the work of the mechanical engineers, both of the regular and the electrical

Referring to the plans which are given below, it will be seen that the whole upper floor, an area 150 feet long by 40 feet in width, is devoted to drawing. The larger rooms are for the use of the lower, and the smaller for the higher classes. Ultimately it is supposed that the whole building may be appropriated to the work in machine design and experimentation, the lower floor being used for the pur-

poses of research, and furnishing the data used on the upper floor in the designing of machines and structures. A room is set apart on the upper floor for the use of the professor having direction of the work, and taking charge of the building and apparatus. A toilet and coat room is provided here, also, for the use of such students as work on this floor. All these rooms are without other finish than kalsomining on the walls; but this is of a light-buff shade, and the ceilings are finished in oiled yellow pine, with the heavy beams supporting it painted a blue-white. Thus the rooms are all well lighted, and are exceedingly bright and cheery. All the heating-pipes are placed overhead; and it is expected that the experience already had with this arrangement will be here repeated, and a thoroughly equable and pleasant temperature obtained. The steam-pipes are also out of the way, and desks, tables, benches, or other furniture can be placed at the windows, and no annoyance felt from the uncomfortable proximity of the source of heat. Lockers are provided for the drawing-boards, while the tables are con-

the use of students working up their data, and another room for special research, which will contain the balances, the few pieces of chemical apparatus needed for gas-analysis, and other work which can best be done here rather than in the general and larger laboratories. The centre of the large room is reserved for a very heavy testing-machine, which it is proposed to place there at some future time.

At the left of the hall, and in the west end of the building, is a group of rooms having special interest to the engineer engaged in work related in any way to steam-engineering. The largest room of the three is devoted to tests of engines, steam-pumps, and various motors (steam, air, gas, and water driven), which will be set up permanently, and to the temporary mounting of small motors sent in for test. A steam-pipe from the boilers in the adjacent apartment, and connecting also with the larger boilers in the main part of the college group of buildings, supplies steam to the steam-engines and steam-pumps. Amongst the machinery here mounted



SIBLEY COLLEGE EXTENSION, CORNELL UNIVERSITY.

structed with drawers to take in the small apparatus; and cases on the walls will be arranged for T-squares and other instruments either too large to be otherwise cared for, or, being the property of the college, such as must be accessible to the instructors at all times.

The lower floor is constructed and is finished very much like the upper; but it is appropriated to a most interesting and novel part of the work of the college. In the middle of the building is a transverse hall out of which opens the toilet and coat room. At the right, on the east side of the hall, is a large room, of similar size to the great drawing-room overhead, in which are placed all the testing-machines for use in investigating the strength and other properties of the materials used in mechanical engineering and construction, including several tension-machines made by Rhie, Fairbanks, Olsen, and Brown & Sharpe, a transverse testing-machine built by Fairbanks, an 'autographic recording testing-machine' of the Thurston pattern, designed by Bond, and built by the Pratt & Whitney Company, two sizes of Thurston's lubricant testing-machines, dynamometers of various types and sizes, and miscellaneous apparatus of similar character. Farther toward the right, and at the east end of the building, are a room for an instructor and for

are a straight-line engine built in the college workshops, a Westinghouse engine, a Brayton petroleum-engine, an Ericsson engine (given to the director by his friend, its distinguished inventor), various makes of steam-pump of the best types in the market, and other apparatus and machinery that properly fall into this class.

At the extreme west end of this floor are the boiler-room, in which are the heating-boilers, which are placed there as a reserve and for experimental purposes, and all boiler accessories. A space is reserved at one side for the large experimental boiler, which is proposed to be used in making boiler trials on a larger scale, and for investigations at pressures exceeding those commonly employed, and ranging up to possibly five hundred pounds per square inch. The second of these two rooms is appropriated to calorimetric investigations, including the calorimetric tests of the quality of steam, which are to-day — more than fifteen years after their introduction in this country by Emery and Thurston, and abroad by Hirn — just coming to be recognized as essential to any satisfactory determination of the efficiency of boilers. The various forms of calorimeter now in use will be set up here, and made useful both in regular instruction, as is all the apparatus of the laboratory, and in special researches involving their use. Just outside this end of the building

is a chimney seventy-five feet in height, and having a flue about four feet square, which will be amply sufficient to carry away the gases, and to provide good draught to all the boilers together. It is given this height, partly to give a strong natural draught, such as will be needed in investigations of the efficiencies of boilers at different rates of combustion, and to insure that the adjacent buildings, some of which may ultimately be carried up to a considerable height, may not interfere with its action, and may not receive gases blown from its top. The ceiling of these rooms, and floor of the upper portion of the building, are given the standard 'mill construction,' and consist of two floors of yellow pine, separated by an intermediate layer of cement. The floor is carried on heavy beams, and left unlathed and unplastered; the lower surface of the ceiling being given an oil finish, and the beams painted as over the upper apartments.

The structure is an example of a successful attempt to secure large, comfortable, and well-lighted rooms at small cost. The construction is as simple as possible, and the finish is of the most inexpensive character. The result is thoroughly satisfactory, if we may judge from the limited experience so far had with it.

CO-OPERATION ON THE CONTINENT OF EUROPE.

III.—AUSTRIA, ITALY, BELGIUM, SWEDEN, AND THE NETHERLANDS.

FROM Austria the answers to Lord Rosebery's circular (see *Science*, No. 220) are based on the reports of the inspectors of industries. In Vienna there are several societies founded by workmen, which, from small beginnings, have so developed that they now afford facilities of cheap supply to many thousand families. One of the most important of these associations is the *Arbeiter-Spar-und Consumverein* (Workmen's Saving and Supply Association) in Fünfhaus (registered as an unlimited liability company), founded in the year 1865 by fifteen working-men, and which now contains about 3,800 members. Any person, without distinction of station or sex, can become a member of the association. Nearly half the members, about 1,600, belong to the class of working-men, while the remainder are independent mechanics, tradesmen, small officials, pensioners, widows, etc. Each member pays an entrance-fee of 30 kr. to the reserve fund, and a subscription of 10 fl. for a share.

The members have the right of speaking and voting at the general meetings, of procuring goods at the stores of the society, and of claiming a share in the profits. In addition, each member is allowed to make savings deposits to the amount of 500 fl. These deposits yield an interest of six per cent, and can be withdrawn at any time, together with the interest, on giving notice beforehand. All goods bought must be paid for in cash.

At least five per cent of the net profits are paid to the reserve fund, so long as the latter does not amount to twenty-five per cent of the members' capital. Out of the amount which remains, interest at six per cent is paid on the shares, and, should any further sum remain, it is paid in dividends to members according to the amount of goods purchased by each during the year from the society. The association is managed by the board of directors, the council of inspection, and the general meeting. The board of directors, which is composed of the manager, the cashier, and the goods manager, are elected for a period of three years from among the members in a general meeting. The board of directors represents the society in its public dealings, and is charged with conducting all its business affairs. The members of the board receive a salary. The council of inspection, which is charged with watching over the management of the business by the board of directors, consists of fifteen elected members, who receive no salary. The general meeting has to consider and decide upon all matters of importance which affect the society, and these meetings are held quarterly. The accounts are balanced quarterly.

It seems that the governmental reports furnish no statistics of the number of co-operative societies in the whole of Austria. The only reliable information on the subject is found in a report drawn up in 1881 by Dr. Hermann Ziller, editor of the *Genossenschaft*, the organ of the General Union of Industrial and Provident Societies in Austria, of which union he is the founder and director.

The subjoined table gives the number of co-operative societies in lower and upper Austria, Salzburg, Tyrol, Vorarlberg, Styria, Corinthia, Krain, the seacoast, Bohemia, Moravia, Silesia, Galicia, Bukovina, and Dalmatia, in 1881:—

People's banks.....	1,129
Consumers' societies (selling food, clothing, etc.).....	235
Societies for assisting artisans in buying materials wholesale....	6
Societies for supplying agricultural implements, manure, etc....	14
Raw material and selling-depots.....	2
Selling-depot.....	1
Artisans' producing associations.....	41
Agricultural producing associations.....	61
Building societies.....	5
Trading societies.....	10
Insurance societies.....	2
Various.....	9
Total.....	1,515

All societies in Austria, of which the number of members is unlimited, and which seek to benefit them by carrying on business in common, are required, by a law passed in 1873, to be registered either as limited or unlimited liability companies; the measure of liability in the former case being fixed by their rules, which, however, do not generally make members liable for more than double the value of their shares, and their responsibility terminates by law after their membership has ceased for a year. In unlimited companies the liability extends through the second year after the expiration of membership. In 1881 something less than two-fifths of the societies tabulated above were registered with unlimited, and rather more than two-fifths with limited liability; about one-fifth were unregistered.

People's banks are the most numerous co-operative societies in Austria. As has been already seen in Dr. Ziller's table, there were 1,129 of those associations in 1881. They were unequally distributed over 10 different provinces; Bohemia having 425, Moravia 304, Galicia 140, and Lower Austria 128, the other provinces only contributing in numbers varying from 2 to 33 to the total. About half these societies were unlimited as to liability.

The people's banks may be divided into two groups. The first, the majority, are open to all classes, and their members are generally tradesmen, artisans, and farmers; the minority, which form the other category, are open only to officials. The total number of the latter kind of societies in Austria was 79, more than two-thirds of which are in Lower Austria, the metropolitan province. Only 696 societies made a return of the number of their members, which amounted to 296,648, giving an average of 426 members per society.

Austria has no co-operative societies for shipping or fishing. Of the 61 agricultural co-operative societies, 59 are dairies and cheese-farms. There is one co-operative association for bee-culture, and one for hop-growing. In 1881 five co-operative building societies existed. Their object was to provide dwellings for artisans. They were not financially successful, and are now in liquidation.

In Italy co-operation has gained much ground since 1883, though it has been known for twenty-five years. Before 1883 co-operative institutions were hampered by legal restrictions. The old commercial code did not recognize co-operative societies as such, and they had to exist as limited liability companies. The code of 1883, however, directly recognizes co-operative societies, and regulates their administration.

Instances of various kinds of co-operative associations are now to be found in Italy; but by far the most important, in regard to their numbers, capital, and success, are the co-operative or people's banks (*banche popolari*). Co-operative stores (*società co-operative di consumo*) for the purchase and retailing of provisions, fuel, and other necessities of life, are fairly numerous and successful among the working-classes in cities and towns. In many cases their establishment is due to the initiative of friendly and mutual-benefit societies, and sometimes the two objects are combined by one association.

A law passed in 1870 exempts co-operative societies from the payment of *octroi* (or local entrance dues) "upon goods provided by them for distribution solely among their own members, for purposes of benevolence, and for consumption at the homes of those persons to whom the distribution is made."

This statute led to a considerable increase in the number of co-operative stores, and cases occurred in which the privilege was abused; and the real object of the society itself, or of individual members, was to defraud the *octroi* by introducing goods for purposes of trade. In order to prevent similar occurrences, the constitution of most co-operative store associations expressly forbids the members, under pain of expulsion, from allowing strangers to deal at the store in their name, or from selling the goods obtained there.

No statistics respecting the number or capital of these stores have yet been published.

Co-operative associations for purposes of production exist in Italy under various forms, but they are not very common, though, since the new commercial code came into force, their numbers have increased considerably.

They are generally established by and limited to members of the same trade or occupation, and exist at present among masons, bakers, macaroni-makers, tailors, milliners, rope-makers, printers, etc.

The associations for production are either intended (*a*) for the purchase of raw materials, tools, etc., or (*b*) for the exercise in common of the trade to which they refer, whether in a co-operative workshop or otherwise.

The fundamental difference between the German and Italian co-operative banks consists in the varying degree of responsibility imposed on their members. While the German institutions are based on the unlimited liability of their shareholders, the Italian banks have, from the first, adopted the principle of limited liability. With regard to this difference, Italian writers point out that the assumption of unlimited liability would have deterred persons of means and education, whose assistance at the outset was more indispensable in Italy than in Germany, from becoming members, and at the same time the character and habits of the people themselves would have disinclined them from entering any associations involving so great a risk.

Some co-operative banks with unlimited liability have, it is true, been established in Italy during the last few years, chiefly in Venetia, at the suggestion of Dr. L. Wollenbourg, but these are only about ten in number.

Industrial co-operative stores are very generally established in Belgium, having as their main object the wholesale purchase, and retail sale at wholesale prices, of the chief necessities of life to the working-classes, such as food, clothing, boots, linen, etc. Credit is not usually allowed. A certain portion, sometimes as much as fifty per cent of the profits, is set aside to form a reserve fund, the remainder being shared amongst the members in proportion to the amount of their purchases. A member, on joining one of these societies, is bound to pay in, either at once or by instalments, a certain sum to the fund. Should he not have paid it up when the dividend is declared, his share of the profits is withheld, and goes to complete his contribution.

If a co-operative society has only a small capital, no store need be opened; but contracts are made with the local tradesmen, who, in return for the society's custom, undertake to sell their goods at reduced prices to the members. The usual practice in such cases is for the members to buy their goods at the same price as the public, receiving at the time of purchase a ticket on which is noted the amount of their purchases. The owners bring their tickets at fixed periods to the committee of the society, and receive in exchange their share of the percentages allowed by the society's tradesmen, and paid direct by the latter into the common fund of the society. Such percentages rarely exceed six per cent.

Sometimes, as a substitute for this ticket-system, the societies distribute to their members counters or tokens, representing 5 fr., 2 fr., 50 c., 20 c., such tokens being of a different color for each tradesman. For instance: a member who wants to buy meat obtains from his society a counter in exchange for his money, representing the cost of the meat he requires, which he receives from the society's butcher at the ordinary rate, his purchase being entered in a special register kept by the butcher. At the end of each month the society's tradesmen receive from the committee the money equivalent of these tokens. Supposing that the butcher brings 100 fr. worth of tokens, and has agreed to allow a reduction of 10

per cent, the society pays him 90 fr., and the 10 fr. percentage goes towards the society's general dividend fund.

Both these systems obtain in large cities, where the working-classes are much scattered; but provided the society has sufficient capital, and can open one or more branch depots, the store system is, in the long-run, more advantageous to the members.

One of the most powerful of the co-operative societies in Belgium is the Flemish Vooruit Society, the centre of the socialistic movement in Belgium.

This powerful association counts on its rolls 2,700 heads of families, each of whom is bound to pay a trifling subscription annually to the general fund. The Vooruit is the type and model of all similar institutions in the other Belgian cities, is well administered, owns premises of considerable extent, and has already attained a good financial position. Attached to it is an admirably organized steam-bakery, which sells bread at a somewhat lower price than the other bakers can afford to do, the society guaranteeing to the bakery a minimum profit of at least 10 c. the kilogram. The profits of the bakery are divided as follows: a certain portion is paid into the society's own *caisse de prévoyance*, or provident fund; another into a fund for the support of the workmen in their economical struggles and strikes; a third portion is devoted to the formation of a library; and the remainder is divided amongst the members, who receive the profits in kind, that is to say, in loaves delivered gratis, according to the margin of profit left to be distributed. This division of profits is made twice annually, — at the new year, and at the summer 'kermesse' fair.

In June, 1885, the profits amounted to 43,738 fr. 20 c.; in December last, to 46,233 fr. 80 c. This bakehouse may be regarded as the mainspring of the whole Vooruit organization. It also has a clothing-store, a pharmacy, and two newspapers.

The Vooruit Society intend to push the principle of co-operation to its extreme limits, and has already very seriously crippled the small retail dealers, who formerly enjoyed the custom of the Ghent workmen.

Hitherto no official returns have been published showing the progress of co-operation throughout the kingdom, but the present government have recently re-organized an industrial department in the ministry of agriculture, which, without infringing on the freedom of the societies, will furnish precise statistics respecting all co-operative institutions.

With the exception of the cotton-manufacturing districts in the provinces of Drenthe and Overijssel, there are no great industrial centres in Holland, and, although there is a considerable amount of manufacturing industry in the country, it is too scattered to favor the formation of co-operative institutions; besides which, the southern Catholic provinces of Brabant and Limburg appear up to the present totally inaccessible to any such efforts, which are not encouraged by the clergy. The General Workman's Union of Holland does not number more than 4,000 members, and the efforts made to form regular trades-unions have as yet been attended with but partial success. There are not more than a dozen workmen's co-operative stores in the entire country, and none of them are of any importance.

Co-operative societies exist in certain parts of Sweden where there are large industrial works in the country or in small towns, the workmen subscribing together to buy the stock of supplies wholesale, the same being then sold retail to the members at a cheap rate. Any eventual surplus would probably be divided.

Co-operative stores also exist in Stockholm and other towns copied from the English system. Mr. L. O. Smith, a capitalist and member of the First Chamber, went over to England some years ago, and studied the system as worked at Manchester and other large centres of manufacture, and started the co-called *Arbetsarering*, or Working-Men's Co-Operative Society, with stores and eating-houses, or 'steam-kitchens,' as they are called, where an ample dinner can be obtained for from about four-pence to four and one half pence. These stores have been so far successful that they have lowered the prices of the necessities of life for the working-classes; but the hope of the founders was, that, when once started, the workmen would take over the management of these stores and keep them going. This hope, however, has not been satisfactorily realized. The numbers frequenting the stores and

eating-houses have fallen off, and a tendency to go back to the private shops has manifested itself.

There are numerous co-operative building-societies in Sweden, but the system has not been extended to agriculture, nor, to any considerable extent, to fishing.

MENTAL SCIENCE.

Healing Wounds by Mental Impressions.

PROFESSOR DELBOEUF of Liège is certainly the most versatile of living investigators, when one considers the great originality and suggestiveness of all the work he does. Ancient and modern languages, logic, general physics and physiology, and especially experimental psychology, have received his attention by turns. His latest contribution is to therapeutics, and is a communication made on June 4 to the Belgian Academy, which will probably turn out to be of the greatest theoretical as well as practical importance.

We all are familiar with accounts of the wounds inflicted on themselves by African dervishes; but the statement which the narrators always make, that the wounds do not inflame, or may even be quite healed in twenty-four hours, probably often tends to discredit their whole description in the reader's mind. Delboeuf's observations now make these stories wholly plausible. It is well established that in certain hypnotic subjects a suggestion made during trance, that to a part of their body a cautery or a blister is applied, will produce, after due lapse of time, an actual vesication of the skin. The hallucinatory feeling of inflammation produces in these persons a genuine inflammation. M. Delboeuf argued from this, that the feeling of pain, however useful in other respects, must itself be an inflammatory irritant, and went on to infer that the abolition of it from an actual wound ought to accelerate its healing. He immediately thought of some hypnotic subjects whom he had made anæsthetic, and in whom he had often admired the rapidity with which the marks of punctures and pinchings disappeared, and proceeded to more systematic experiments, which, so far as they go, seem to verify his hypothesis perfectly. On a young woman whom he could make insensible by suggestion, he marked two corresponding spots, one on each arm, and made on each an identical burn with the hot iron, announcing to the patient that the one on the right should not be felt. The suggestion took effect; and the next day, when the bandages were taken off, and the left arm presented a vesicled sore with an inflammatory area three centimetres in diameter, the right arm showed only a clean scorch of the skin of the exact size of the iron (8 millimetres diameter), without redness or inflammation. On another subject similar results were obtained with burns and blisters, the spots chosen being near together on the same arm or on the neck. The experiments are few in number, and ought to be multiplied; but the reader will immediately see the vista which they open. Many of the results of the 'mind-cure,' and the strange fact, so long known, of opium controlling inflammations, are explained by M. Delboeuf's principle. So is the popular belief in 'hardening' one's self by a little judicious indifference, and neglect of one's condition. Local pain is useful in leading us to protect the wounded part from mechanical abrasion,—several of M. Delboeuf's experiments were inconclusive, because the subjects, being insensible at the seat of their injuries, allowed them to get scraped, etc.,—but it has the drawback of exciting reflex changes of nutrition of an unfavorable kind. Anæsthetizing a wound prevents these reflex changes. M. Delboeuf, suggesting to a very sensitive subject that she should not feel a severe dental operation, was assured by the dentist that what he found most extraordinary in the whole performance was the absence of the salivary secretion which would usually have accompanied it.

It is to be hoped that others, with better facilities for surgical experimentation than a professor of classical literature like M. Delboeuf, will follow the example he has so happily set them.

BOOK—REVIEWS.

Technical School and College Buildings. By EDWARD C. ROBINS, F.S.A. New York, Van Nostrand. 4°.

THIS handsome volume by a gentleman who holds a most honorable position among architects and friends of technical education, is inscribed to Professor Huxley. It is a treatise on the design and

construction of applied-science and art buildings, together with a description of their suitable fittings and sanitation. Its value will be apparent at once to every one, but especially to those professors and instructors who desire to utilize the results of the best European experience in their laboratories, museums, and lecture-rooms. Our medical and educational readers will recall the pains taken by the trustees of the Johns Hopkins Hospital in Baltimore to obtain the benefit of the best thought and ripest experience of the world in relation to their work, and will readily understand how a book of this scope relating to hospitals would have lightened their labors.

In this country we are now passing rapidly forward in the construction of school-buildings and laboratories, and, whether they are large or small, our desire is to have them as complete as possible. It is here that European experience is so valuable, and Mr. Robins has done us a great service in putting into a readable form accounts of what has been done in the great schools and universities of Europe. His book contains full descriptions of such famous institutions as the Bonn, Berlin, and Munich Chemical Laboratories, Du Bois-Reymond's Physiological Institute at Berlin, the laboratories of the Royal Trade School at Chemnitz, the Würzburg Physical Institute, the Royal Technical School at Stockholm, the laboratories at Charlottenburg, Zurich, Paris, and Strasburg. Most of these are accompanied with cuts and diagrams, so that their interior arrangements may be studied in minutest detail. Following these come full descriptions of the laboratories at South Kensington, Finsbury, Leeds, Bristol, Manchester, Huddersfield, Oxford, Cambridge, and other English cities. The chapters which follow on the fittings of these buildings are in one sense the most valuable of all; for they give us the most detailed information concerning the hundred and one minor things which go to make up the perfect laboratory. They discuss and describe, for example, the working-benches, demonstration-tables, drawing-rooms, and so on. The heating, ventilation, and sanitation of applied-science buildings are also elaborately treated and profusely illustrated. An appendix gives statistics as to the technical schools in Great Britain, and we find there particulars as to the area occupied by the buildings, their cubical contents, the cost of land, cost of fittings, annual expense of maintenance, number of students, and so forth.

Mr. Robins's book is one which our investigators in physics, chemistry, and biology, our university architects, and our technical educators, cannot do without.

The Natural History of Thought, in its Practical Aspect from its Origin in Infancy. By GEORGE WALL. London, Trübner. 8°.

THIS volume is in many ways a serious disappointment. Much of this effect is due to the fact that the expectations raised by the inviting titlepage are not in the least realized. Had these pages appeared with a less ambitious title, one could have judged them much more leniently than it is possible to do when considering them as an attempt to write a life-history of the thinking process; and this failure is made a hundred-fold more striking by the consideration that science is in a far better position to deal with this problem than ever before. At no very distant date it will be possible to write a natural history of thought that shall be regarded as an illustrious consummation of a most important movement,—the application (as the term 'natural history' suggests) of the biological point of view to the consideration of mental phenomena. Even now a master-hand could sketch the outlines of such a comprehensive undertaking. To blame Mr. Wall for not being such a master-hand would be very unjust; but the same cannot be said when fault is found with his lack of appreciation of the complexity of the problem before him, and the important light which recent experimentally discovered facts have shed upon it. The natural history of thought can be far better gleaned from such a volume as Mr. Tylor's 'Primitive Culture,' or (to make the comparison more immediate) from M. Perez's 'The First Three Years of Childhood,' than from the pages of Mr. Wall's book.

The volume is really a collection of educational essays, written by an observant thinker, deeply imbued with the high pedagogical value of moral training, and in particular with that portion of it usually termed 'religious,' and appreciating here and there the

scientific aspect of these problems. He writes well, says some things very forcibly, but repeats himself *ad nauseam*, crowds his pages with commonplaces, and warps his exposition by an irrelevant and forced introduction of religious considerations. With this survey of the strength and the weakness of the work, a glimpse at its contents will be in order.

In the introductory chapters, on the nature and the function of thought, the only point of note is, that, while the author fully recognizes the significance of mind in animals for the understanding of mind in man, he erects a barrier between them which the evolutionary point of view demanded by the topic finds inconsistent. This distinction between a lower and a higher field of thought, — the two sharply defined, — while of advantage in accenting the peculiarity of human evolution, is yet a decided hinderance to the taking of that general point of view which imbues mental evolution with a larger interest. Hereupon follow a chapter on language, and one on temper, containing much sound advice, but nothing noteworthy. The next four chapters aim to justify the titlepage, and deal respectively with babyhood, infancy, childhood, and youth. The characteristics of each of these periods are pleasingly sketched; but the sketch is incomplete, and dwells in a disproportionate manner upon the moral-religious side of the question. He believes in the careful training of children from their first days; denounces the practice of giving children to the care of ignorant nurses when they are supposed not to be affected by their surroundings, but are really forming habits of character for ill or good. A very apt saying is the author's remark that much that is learned in childhood is not taught, and much that is taught is not learned. And the reason for this he rightly finds in the fact that the child, in his own acquisitions, discovers (by repeated trial and failure, it is true) the natural mode of learning, with interest, timeliness, utility, and attractiveness to help him; while the teacher too often accentuates the artificiality of his task.

The latter half of the volume is devoted to chapters on the habit of thought, on the control of the thinking faculty, on memory, on judgment, on inherited capabilities, and on the early training of the mind, and, to a much too large extent, is a repetition of the first half of the book. In the chapter on inherited capabilities the writer exhibits a tendency which he has in common with other thinkers of the day. The writers in question are unwilling to dispense with the rich suggestiveness of the evolutionary point of view, and the light shed upon mental phenomena by the consideration of their physical substrata, but are equally unwilling to give up the general theories — partly religious and partly not — inculcated in their early training, but really incompatible with a consistent evolutionary treatment. The result is at times a curious mixture. The arbitrary curtailing of the evolutionary principle at one point, and an omission to carry to its full consequence the general principle with which it is at variance, give the appearance of a harmony which a deeper consideration shows to be due, not to the fact that the two lines do not run in opposite directions, but that they have been carefully kept from meeting. Mr. Wall is afraid, that, if we admit that our moral and other qualities are to some extent hereditary, this will loosen the bonds of responsibility, and do other moral havoc (a fear, by the way, not at all justified by the history of morality, which clearly shows that new duties follow in the wake of new knowledge), and so refuses to accept the doctrine. In this attempted refutation he draws heavily on preconception instead of on logic and fact. He boldly announces that the child before birth has no life at all, a statement which no biologist will accept; speaks of 'phrenology' as though it were adhered to by scientific men; raises the will into a metaphysical entity, and makes it dominate the reason (as though the former were not a brain quality in the same sense as that in which he acknowledges the latter to be); and refers what we usually call inheritance to early educational influence and the different use of faculties originally alike. In short, the chapter lamentably illustrates the hopelessness of serving two masters.

To leave the reader with a brief verdict of the book, let it be said that it will be suggestive to those interested in this line of thought, but cannot be recommended to those desirous of learning in a short time the modern view of this problem; but with this verdict one must remember the inherent difficulty of the problem, and the

fact that the author pleads temporary blindness as an excuse for the literary shortcomings of the work.

Public Debts. An Essay in the Science of Finance. By HENRY C. ADAMS, Ph.D. New York, Appleton. 8°.

POLITICAL economy in the United States appears to have followed the order of development which Auguste Comte maintained was the law of evolution for all science. We have first the 'theological' stage of science. Certain *a priori* ideas regarding the nature of Deity serve as premises from which conclusions are drawn regarding the phenomena of the industrial world. Carey gives an example of this when he argues from the goodness of God that the Malthusian theory cannot be true. Perry's 'Text-Book of Political Economy' is, however, the best illustration in current economic literature of what is meant by the theological stage of science.

The second stage in the evolution of science was called by Comte the 'metaphysical.' *A priori* ideas still furnish premises for conclusions, but they are not theological: rather are they hypotheses concerning the mind of man and the material universe, which have been derived from processes of reflection. Facts are made to square with theories; and in case they cannot be made to do this, why — "so much the worse for the facts." The English orthodox political economy was well described by Comte's metaphysical stage of science; and with the theological political economy this held sway — almost undisputed sway — in the United States until some fifteen years ago. Its most distinguished representatives declared that it was not eager for facts, because it was in possession of general principles which explained the facts.

The third stage of knowledge Comte called the 'positive.' This deals with phenomena, grouping and arranging these. Comte's description of the progress of science is, I believe, now allowed to be faulty in its details, even by his most ardent admirers; but, on the other hand, those who are not his followers can scarcely deny the correctness with which he laid down certain main lines along which human knowledge has advanced, from the time when Socrates urged his disciples to give up empty speculations about the heavenly bodies for an observation of human phenomena, up to the present. The remarkable development of economic and social science in the United States, now attracting attention in Europe as well as in our own country, is due to a change of method and of purpose, both admirably illustrated in the present work on public debts. Professor Adams examines the facts of our economic history, and from them he draws conclusions respecting a sound financial policy for our Federal government, our States, and our municipalities. The older method would have been to search our history for facts to bolster up certain theories assumed before the book was begun. A change in purpose is as important as one in method. The change in purpose to which I allude is this: the tendency of modern economists is to renounce the position of mere advocates, — almost universally assumed by the older economists, — and to search for truth, like other scientific men, regardless of consequences. The old idea of the duty of an economist was that he must combat heresy, whereas heresy is something unknown to science. Clark's 'Philosophy of Wealth' and James's 'Relation of the Modern Municipality to the Gas-Supply,' both of which have been reviewed in *Science*, may be cited as other illustrations of the most recent tendencies in American economics.

The scope of this admirable work can be most readily gathered from the titles of the parts and chapters into which it is divided. Part I. treats of public borrowing as a financial policy; Part II., of national deficit financing; Part III., of local deficit financing. The opening chapter of Part I. first brings before the reader most vividly the facts in regard to the growth of public debts; and it is certain that few will read these pages without gaining a new idea of the tremendous significance of this factor in modern industrial life. Professor Adams opens his book with these words: "The civilized governments of the present day are resting under a burden of indebtedness computed at \$27,000,000,000. This sum, which does not include local obligations of any sort, constitutes a mortgage of \$722 upon each square mile of territory over which the burdened governments extend their jurisdiction, and shows a *per capita* indebtedness of \$23 upon their subjects. The total amount of na-

tional obligations is equal to seven times the annual revenue of the indebted States. At the liberal estimate of \$1.50 per day, the payment of accruing interest, computed at 5 per cent, would demand the continuous labor of three millions of men. Should the people of the United States contract to pay the principal of the world's debt, their engagement would call for the appropriation of a sum equal to the total gross product of their industry for three years; or, if annual profits alone were devoted to this purpose, they would be enslaved by their contract for the greater part of a generation." Chapters II. and III. treat of the political and social tendencies of public debts, and reveal the power of analysis which distinguishes Professor Adams in so high degree. I have particularly in mind those passages in which he shows, that, while public debts do not create class distinctions, they tend to render such distinctions perpetual. The analysis of the public debt of the United States is likewise specially interesting, for it reveals the surprising extent to which that species of property, at least, is concentrated. It appears that out of a total of \$664,000,000 registered bonds, \$410,000,000 are held in sums of \$50,000 and over. As Professor Adams pointedly remarks, this shows the absurdity of those who would have us keep our debt as an investment for widows and orphans. Chapter IV. deals with industrial effects of public borrowing, and Chapter V. answers the question, 'When may States borrow money?'

The topics of the chapters in Part II. are these: financial management of a war; classification of public debts; liquidation of war accounts; peace management of a public debt; payment of public debts.

Part III. opens with a comparison of local with national debts, and then passes on to an able account of State indebtedness between 1830 and 1850. Here, again, we see the difference between the economist as a man of science and the economist as the advocate of some powerful interest; for example, of corporations. The advocate will dwell on the evils of State enterprise when tried, and, passing lightly over those of private enterprise in the same field, will draw the conclusion that corporations can provide all things better than public bodies like cities, States, or the Federal government. Professor Adams, on the other hand, examines the entire field, conceals nothing, exposes unfortunate failures of public undertakings, and finds that in the Western States, whose history in this respect he has most carefully studied, "whether judged from the standpoints of results or of business probabilities, the State authorities showed greater foresight and greater business conservatism than individuals." While Professor Adams does not wish the States to undertake those kinds of business which are at all times subject to the control of competition, and suitable for private enterprise, he holds — and in this I fully agree with him — "that it was a mistake for the States to abdicate certain sovereign functions in favor of private corporations, for the evils thus incurred have proved greater than the evils escaped."

The remaining chapters of the book deal with municipal indebtedness and the policy of restricting governmental duties as a cure for public corruption and mismanagement. Going below the surface of things, Professor Adams finds in the improper restriction of governmental duties a chief source of bad government. It seems to me that this is beyond controversy when the facts are all reviewed. The whole history of industrial society tends to show that public duties can best be performed by public and responsible agents. It was a great step in advance when States ceased to sell their taxes to corporations and individuals, and to collect them themselves. Another step will be taken when public bodies assume the direct management of natural monopolies like gas-works, water-works, and railways. Are not these natural monopolies now a chief cause of disturbance and corruption? And how cure the disease without removing the cause, and how remove corporations from the field of natural monopolies unless governments absorb the duties they perform? In accordance with this view, Professor Adams very properly recommends the purchase of telegraph-lines by the Federal government as a solution of the difficulty which the treasury surplus occasions. We might then have as good a telegraph service as our present postal service.

It is also in accordance with this general view that Professor Adams recommends that treasury management be kept as free from bank agencies as possible. Our experience in the United

States seems to have demonstrated the wisdom of this. Before Senator Sherman became secretary of the treasury, it was customary to place Federal bonds on the market through the aid of syndicates of bankers, but he saved the United States over a million dollars in the sale of four-per-cent bonds by dealing directly with the public.

When I reviewed Professor Clark's 'Philosophy of Wealth' for *Science*, if my memory serves me correctly, I pronounced it one of the ablest works ever written by an American on the fundamental principles of political economy. I have elsewhere spoken of Professor Adams's monograph, 'The Relation of the State to Industrial Action,' as the profoundest study of the industrial functions of the State in the English language, going far ahead of any thing Mill ever wrote on that subject. I believe the present work on public debts the best work, on the topic with which it deals, to be found in any language.

In view of these facts, and others which might be cited, it does not seem rash to venture to predict that within ten years the recognized leaders of economic thought among English-speaking people will be Americans.

RICHARD T. ELY.

NOTES AND NEWS.

LETTERS have been received by the *Montreal Gazette* from Dr. G. M. Dawson, in charge of the Canadian geological party exploring the Yukon district, to date of July 29. The party constructed two boats on Dease Lake, and left on June 3 to descend the Dease River to its junction with the Liard. From that place Mr. McConnell left with two men to descend the Liard. The remainder of the party, with five Indians, ascended the north fork of the Liard to Lake Francis, and, leaving their boats, crossed a long portage of sixty miles to Pelly River, near the abandoned Hudson Bay post of Pelly Banks, where they arrived on the 29th of July, all well. From this place the Indians were sent back, and Dr. Dawson, with Mr. McEvoy and two white men, remained to construct a boat and descend the Pelly to its junction with the Yukon. The country north of Dease Lake proved somewhat varied in structure, having a granitic nucleus with paleozoic rocks on its flanks ranging from Cambrian to Carboniferous, and overlying Tertiary beds. The old portage was found to be entirely disused, and the party had to struggle through tangled woods, often knee-deep in moss. They got over, however, with a month's supply of provisions for the advancing party, and leaving stores cached for the returning Indians. Being north of the latitude of 60°, they enjoyed almost perpetual daylight, and the weather was good. The country is described as possessing well-grown trees, and a great number of the ordinary eastern plants were seen in flower, with some northern and western strangers. Only the great growth of sphagnum mosses and the abundance of reindeer moss give the country a different aspect from that of British Columbia. No Indians had been seen, except those the party brought with them from the coast. Though somewhat later in the season than he had expected to be, Dr. Dawson had still good hopes of reaching the coast before the freezing of the rivers, and the lines of section made by Mr. McConnell and himself will give a good idea of the structure or resources of the country.

— Since starting the third series of his 'Butterflies of North America,' Mr. Edwards has issued his parts in more rapid succession than before, a third number having appeared within the year. As it is the most important iconographic work now issuing in this country, and in artistic merit the peer of any that have yet illustrated the natural history of America, we may once more draw attention to it. Three species are illustrated, all from the Pacific coast, to each of which a quarto plate is devoted. Two of them, species of *Melitæa* and *Argynnis*, have liberal illustrations of the early stages, in which the points necessary to a good understanding of the structure of the caterpillar at different stages are especially well brought out. Considering that the insects had to be raised thousands of miles away from home, from material specially sought for, the success of Mr. Edwards is remarkable. The text in this part is almost entirely made up of technical details; and the third plate, another of the multitudinous species of *Argynnis*, is inferior in interest and in execution to the others, though the latter point would hardly be noticed were it not in a work of such uniform artistic excellence.

LETTERS TO THE EDITOR.

*** The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The Keweenaw System.

THE geologists interested in the discussions that have taken place during the past eight years, concerning the relations of the Eastern sandstone to the copper-bearing rocks of Keweenaw Point, will remember that one of the important localities showing that relation is situated on the Hungarian River. In company with James Osborne, F.G.S., superintendent of the Rio Tinto mines in Huelva, Spain, and William Beer of the Osceola Mine, I have revisited this locality. Owing to some changes in the bed of the stream, we are able to trace continuously the unchanged Eastern sandstone into the sandstone which has been baked and indurated by the old lava-flow, and this baked sandstone into the lava-flow or melaphyr itself, all forming a continuous exposed surface. There is no fault or plane of separation between the sandstone and trap, but the two are welded together into one mass. We procured hand specimens, which in one piece show the contact of the so-called 'Keweenaw' system with the Eastern sandstone. The contact is that made by a lava-flow with an underlying sandstone, and is the same as the contacts so often observed within the copper-bearing series, while the sandstone is observed *in situ* to pass beneath the melaphyr. It is my purpose to uncover the contact junction still further, and to publish in time a paper giving sections and detailing results at this and other localities at which the contact has been observed. The above observations sustain fully those made by myself in 1879; and in this case it would seem to forever settle, beyond any possibility of doubt, that the Keweenaw system and the Eastern sandstone are one and the same continuous geological formation, but with the copper-bearing rocks younger in point of time than the sandstone.

M. E. WADSWORTH.

Michigan Mining School, Houghton, Mich., Sept. 19.

Cause of the Purple Coloring of Pigweed-Leaves.

DURING a number of years past I have frequently been struck by a prevalent purple coloring of patches in the leaves of pigweed (*Chenopodium album*), the cause of which did not appear in any surrounding conditions, and up to this summer it has remained to me a mystery. A few weeks ago, however, while examining pigweed in search more particularly of plant-lice and leaf-miners, I again noticed the leaf-coloring, and, upon turning up some of the colored leaves, found on some of them larvæ of a leaf-hopper having the same shade of purple as the colored spots on the leaves. Further examination brought to light more of the larvæ, always on the under surface of the leaf, and within one of the colored spots. Some of the spots were found without any larvæ visible, indicating that they travel about more or less, or that they had been disturbed and had made use of their legs to get out of the way. A few days later (July 25) I examined plants in another locality similarly affected, and found, as before, the colored larvæ associated with the spots. On one leaf, I found close by the cast-off pupa-skin, which still retained enough of the markings to show its relation to the larvæ (an adult), which, on comparison, proved to be the *Thamnotettix seminudus* of Say,—a species rather common throughout the country, but which, so far as I can find, has never been mentioned in connection with its food-habits or larval life. No such coloring results from the presence of plant-lice or other insects on the same plant, and it seems quite certain that we may consider this species as the cause of the peculiar phenomenon. I am not aware that any explanation has previously been given. What kind of secretion is injected into the leaf by the insect, when puncturing it to obtain its food, and how that acts to change the color in the plant-cells, are still open questions. It is evident that the simi-

larity in color of the spots and the larvæ are a protection to the latter.

HERBERT OSBORN.

Zoöl. Lab. Agric. Coll., Ames, Io., Sept. 20.

The Ordinates of Interest in Science at the American Association.

THE oscillations of interest in branches of science, and the rise of, and rapidly increasing interest in, the more recent and sometimes the less difficult departments of learning, as well as the apparent stagnation in the pursuit of science either locally developed or affecting larger areas of population, have been often remarked. It might seem reasonable to suppose that we might be able to review with approximate accuracy the ebb and flow of the scientific tide by watching the fluctuations of study in a representative and national body of scientific workers; in such assemblages as the American, French, and English Associations present us with, where no discriminations are made, and students of all grades and inclinations are welcomed.

The obvious and feasible method to adopt for this purpose would be to note the varying number of papers by different authors in the several classes of study, and compare their aggregates distributed over a number of years. This method we have used here, and yet a little reflection will show that it is deceptive, and possibly in instances leading to quite wrong conclusions. In the first place, while the names of all scientific men in these countries, as a rule, are found on the rolls of these associations, they may, for reasons of convenience or personal comfort, or because they are associates of smaller and more technically limited bodies, choose to publish or read their papers elsewhere. In the second place, many conscientious workers cannot enjoy the opportunity of attending the meetings of the association, and, while authors in a modest way, would be deterred from appearing upon so prominent a platform, though they become members of the association for the sake of enjoying its publications and the pleasure of its recognition. Again, the 'ambulatory' habits of the association may carry it this year into a hot-bed of geologists or in their neighborhood, and in another move it to the hunting-grounds of archæology; so that the method is defective as permitting just inferences as to the fashion or currents of scientific investigations in the association itself, and more evidently as regards the wholesale aspect of national scientific industry.

And yet, with all deductions made, there is a residuum of interest in the results of this examination. They show how evenly in some branches the 'show of hands' at the annual meetings of the association has been kept up, in others how the interest has fallen under the entire average for years, and again risen by a recuperative effort much above it; they give an idea, at least, how some lines of study exceed others in their active participants in the association, and a measure of the rising importance or popularity of others.

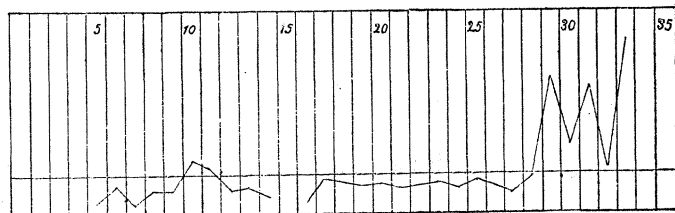
In computing the charts, the whole number of papers by different authors in each department has been taken, and their percentage of all the papers read or accepted, by different authors, used to fix the point of interest in the column corresponding to the number of the meeting quoted. Where an author has prepared a paper on two or more subjects, he is regarded as representing a unit of interest in each; but where he has offered a number on one subject, his activity entitles him to no further recognition, for our purpose, than the single contributions of others. The points of interest are measured from the base-line, and are meant to be strictly comparable; so that the greater general height of one series exhibits the preponderating value of that study. The determination of the proper reference of a paper is in some cases not easy, and the lines might in many ways be changed by a redistribution of the papers, according as the statistician thought the contents of a paper shifted it to a different though allied topic.

Of course, the actual number of papers by different authors in one subject may remain constant, while the percentage of interest would show a decrease, from the re-enforcement of other departments and the consequent larger aggregate of individual papers upon which to reckon. The most instructive conclusions, it seems to us, are drawn from the relative position of the average line of interest, in the different subjects, to the maxima and minima points

and the line passing through them; thus showing at periods an excess over the average, maintained for successive years, and at others a deficit of interest equally prolonged. In many instances the average line lies above the serial points for years, its position being secured by intermittent displays of interest, pushing momentarily the point of interest to a place high above it, for the year in which the display occurred.

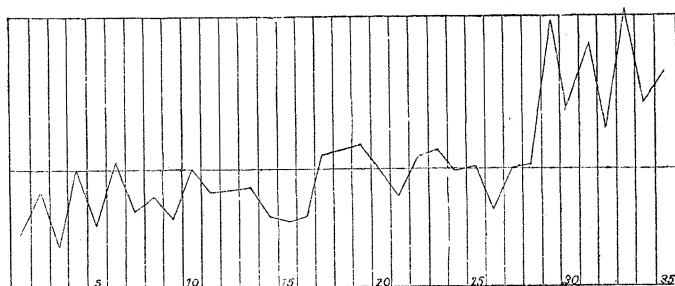
For convenience of reference, the number of the meeting and the place of meeting are here brought together:—

1. Philadelphia.	10. Albany.	19. Troy.	28. Saratoga.
2. Cambridge.	11. Montreal.	20. Indianapolis.	29. Boston.
3. Charleston.	12. Baltimore.	21. Dubuque.	30. Cincinnati.
4. New Haven.	13. Springfield.	22. Portland.	31. Montreal.
5. Cincinnati.	14. Newport.	23. Hartford.	32. Minneapolis.
6. Albany.	15. Buffalo.	24. Detroit.	33. Philadelphia.
7. Cleveland.	16. Burlington.	25. Buffalo.	34. Ann Arbor.
8. Washington.	17. Chicago.	26. Nashville.	35. Buffalo.
9. Providence.	18. Salem.	27. St. Louis.	



ATTENDANCE.

The marked feature of this chart is the striking rise in the last five meetings, the only ones whose percentage is above the average, with the exception of the 9th and 10th. These meetings include some remarkable assemblages, such as those that met at Boston in 1880, Montreal in 1882, and Philadelphia in 1884. The phenomenal nature of those meetings brought large numbers of the members together, elicited enthusiasm, and excited public attention. The Ann Arbor and Buffalo meetings did not continue, we believe, this upward movement.



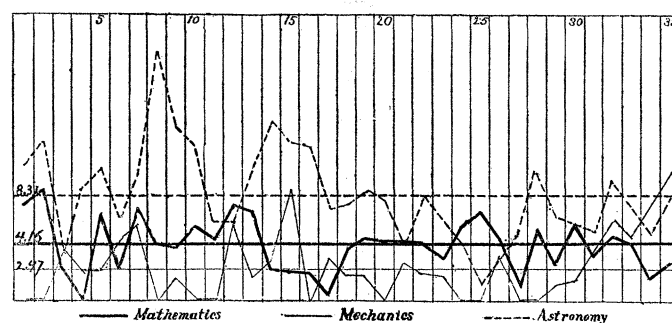
PAPERS.

The papers contributed to the successive meetings, by which is here meant only papers by different authors (except in cases where one author has written in two departments of science), show a synchronous rise with the attendance in the last meetings; but, what is more auspicious, they show an inclination upward from the first, with slight relapses, indicating a prevailing desire among investigators to bring, in some shape, their results before the audience of the association. The papers for the eighth and ninth meetings are low, however, though the attendance then is given as above the average. The rise together of attendance and papers is a healthy sign. It is assumed of necessity that the conditions for admission of a paper are no less or more stringent than formerly.

Mathematics, as might be expected from its difficult and unpopular nature, has a low percentage of interest, 4.16. We do not know how this compares with the percentage in other countries, but it must be considered in connection with astronomy, and to some extent with mechanics,—studies of a mathematical habit. Mathematics maintains itself fairly well near the average, rising and falling about equally, and in one part of the series running almost on the line.

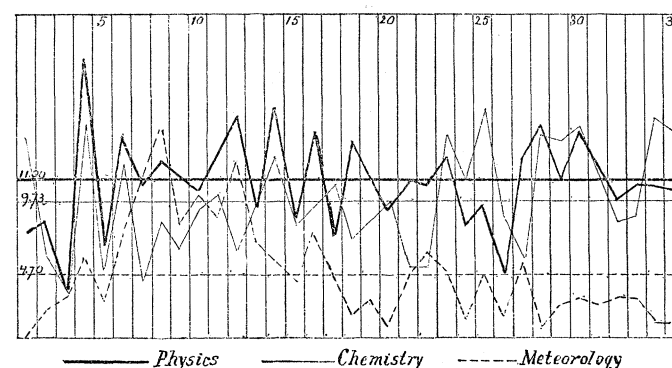
Astronomy has a high average percentage of interest, keeps above the line of average during the first half of the association's

existence, but is pushed down in the second half by the intruding recruits to other subjects. This is well shown by the fact that at the Boston (29) and Buffalo (35) meetings the actual number of papers assigned to this subject were only one less in each case than the number at the Washington (8) meeting, when the interest reached its highest point.



The chart of mechanics shows that after comparative apathy and violent fluctuations the points of interest have started upward with probably a significance as yet undetermined. The technical societies, engineering associations, etc., absorb the papers of the mechanical minds, and the recent accessions of papers may have some reference to the condition of these bodies.

Natural philosophy and physics has a high percentage of interest, and its points oscillate up and down over the average line with quite even regularity. Its fascinating qualities and intellectual importance will assure it a steady flow of support, though the later indications would suggest that its percentage will be lowered in succeeding years, as it fails to reach the average for four years. In this subject personal judgment and ignorance may have led us into error, and papers assigned to chemistry might almost as justly claim admission with this.



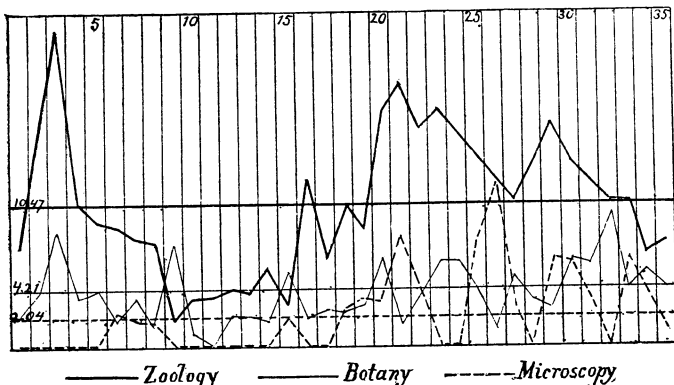
Chemistry everywhere claims attention, and each year its domain and its explorers seem increased. Yet its average of interest is kept up by spurts during the earlier life of the association, a settled higher tendency becoming established only from the 23d (Hartford) meeting, onward. The north-eastern cities seem to stimulate its life in the association, and, generally speaking, it drops as the meetings recede from the Atlantic area. This is less noticeable in recent years, and indicates a wider dissemination of its professors.

Meteorology, which has assumed such first-class prominence in practical affairs, and has attacked new problems formerly unthought of, shows a falling-away of interest in the later years of the association, its average being held up by the tall developments in the 8th to the 13th meetings, when some enthusiastic workers attracted attention to it, unopposed by the widening scope of other branches. It seems to have reached a low ebb, and may show a dangerous facility to disappear altogether.

The average percentage of interest in zoölogy is high, as might be expected; but it seems significant that its points lie beneath the average line in the former part, and above in the latter part, of the association's history. A tendency is discernible, however, toward a lower scale, as from both the 21st (Dubuque) and 29th (Boston) there has been a falling-off, producing the slopes shown in the chart. The sharp ascent in the 3d (Charleston) meeting was given

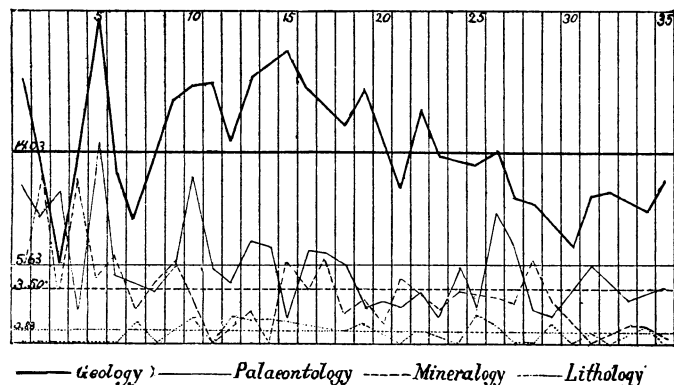
by eight papers in a total of thirty-four, but the relative interest declined after this to a low ebb for eight or nine meetings.

Botany has not been a feature in the association until recently, and its record shows a simultaneous increase in interest. It has not oscillated widely above or below the average, and has been maintained by a band of writers who, while they permitted it to reach extinction in the 11th (Montreal) meeting, have vigorously kept up its respectability. The new and younger botanists have made themselves felt, and it may be anticipated that in the next decade its percentage will rise.



Microscopy has only in later years assumed any importance in the meetings of the association, and in the United States it is only in later years that the use of the microscope has been widely extended. Industrially, technically, in biological and botanical studies, it is beginning to make itself recognized as the handmaid of business and science. Microscopy is yet fitful and timid in its appearances at the association, but these erratic fluctuations probably precede a more even participation in its work.

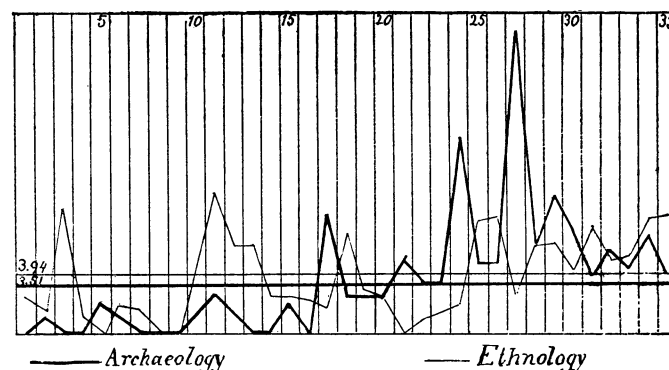
Geology shows the highest percentage of interest (14.03), as might have been expected, amongst the departments. The association itself was the child of a geological club; and geology in a new country, abounding in new details, new material, new problems, apart from its intrinsic value and fascination, attracts numerous followers. Abundance of papers on this subject have always been forthcoming, in this arena met the veterans of the science, and here the everlasting quarrel over 'taconic' and 'primordial' has been fought over again and again, with the confusion of less noticeable collisions and the combat of less distinguished warriors. One thing of interest is observable; i.e., that geology is losing its hold: as with astronomy and other subjects, the growth of new departments, the increase of papers in other branches, is forcing its average down, though the actual numerical display of papers is higher.



Paleontology has a fair percentage of interest, has been quite uniform, but evincing a downward inclination, caused, as with other topics, by the enlarging horizon of the society's activities.

Mineralogy has an intermittent and rather low pulse, but from the 15th (Buffalo) to the 28th (Saratoga) meetings was in a rather healthy state, and has since kept below the average. Its average, indeed, has been sustained by the high percentages given in the earlier meetings, and its general temper is debilitated.

Lithology has barely an existence in the association. The subject is new, its students few and scattered, and much of its material absorbed in papers which are properly geological. Lithology will undoubtedly enter more largely into public scientific discussion in the future.



Ethnology and archaeology have been the elements of disturbance which have intruded numbers of papers in recent years, and brought down the percentage of interest in other branches not sufficiently recruited by new accessions. The significant coincidence in the general aspect of these two branches of study shows their important development in the last ten years. They threaten the supremacy of the older studies, both because of their popular character, the interesting nature of their results, and the fertile soil for anthropological investigation in our country.

And here we are suggestively reminded that a valuable analysis of the association returns might be made to determine in what quarters the scientific industry of the country is located. Finally, we offer these observations, imperfectly and too hastily prepared, as a contribution to the interest this meeting of the association should excite.

L. P. GRATACAP.

A North Carolina Diamond.

A DIAMOND weighing $4\frac{1}{2}$ carats and 873 milligrams was found on the Alfred Bright farm in Dysartville, McDowell County, N.C., in the summer of 1886, by twelve-year-old Willie Christie, the son of Grayson Christie, who was sitting on a box at a spring, and saw, about two feet from him, what he termed 'a pretty trick.' He picked it up and carried it home, where it lay on the shelf two weeks before he gave it another thought. It was then taken to the village grocer's, John Laughridge's, where various opinions were passed upon it, until at last the conclusion that it was a diamond was reached. It was then sent to Messrs. Tiffany & Co. for valuation. It is quite perfect, but not pure white, having a faint grayish-yellow tint. In form it is a distorted hexoctahedron with partial



twinning (see figures of two views). Its specific gravity is $3.549+$, and it measures 10 millimetres in length and 7 millimetres in width.

This stone being more than an average find, the writer thought it would be of interest to visit the locality, and while there in June, 1887, he fully authenticated all the facts of the finding. Dysartville is sixteen and one-half miles from Morganton, twelve from Marion, eight from Bridgewater, and four from Capt. J. C. Mills's gold-mine. A number of supposed diamonds, which proved to be zircon or smoky quartz, have been found here before. No trace of garnet, peridotite, or any of the associations of the diamond, were found near the spot. The sediment at the bed of the spring was taken out and carefully examined, as also the small hollows on the adjacent hillside. This diamond must therefore have been transported in decomposing soil from distant higher ground in the vicinity, during a heavy freshet. Its value as a gem, not counting any value its American origin may attach to it, would be from about one hundred to one hundred and fifty dollars.

GEORGE F. KUNZ.

New York, Sept. 27.